6.1 Rocks and the Rock Cycle

→ The material that makes up the solid parts of the Earth are rocks

I. Three major types of rocks

A. Igneous - forms when magma, molten rock, cools and hardens

1. Magma is called lava when it appears on Earth's surface

B. Sedimentary rock - forms when sediments deposit and are compressed, cemented together, and harden

C. Metamorphic - forms when existing rock is altered by tremendous pressure, extreme heat, and or chemical processes

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II Rock Cycle

A. Geologic Forces cause rock to change from one type to another

→ Become familiar/know Figure 2, p. 126

B. Much of the rock in the Earth's crust has probably passed through the rock cycle many times over Earth's history

III Properties of Rocks

A. All rock has physical and chemical properties that are determined by how and where they formed

1. Physical characteristics generally reflect chemical composition of the rock and the individual minerals involved with the rock

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B. Bowen's Reaction series (Figure 3, p. 127)
1. The simplified pattern that explains the order in which minerals form as magma solidifies
2. According to the Bowen Reaction Series, Minerals form by two ways
a. gradual, continuous formation of minerals with similar chemical make-up
b. sudden changes in mineral types
C. Chemical Stability- the measure of a minerals ability to resit breaking down
1. The rate a mineral breaks down is determined by chemical stability
a. dependent of strength of chemical bonds
D. Physical Stability- rocks have natural zones of weakness
1. Massive igneous rock structures commonly have spaced zones of weakness called joints

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6.1 Review

Grade: 9th

Subject: Earth Science

Date: 12/4

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1 Process by which new ~~froms~~ rocks form from old rock

A rock
B texture
C rock cycle

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2 Process by which sediment is dropped and comes to rest

A erosion
B composition
C deposition

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3 Solid mixture of one or more minerals and organic matter is a _____

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4 What forms when rock partially or completely melts?

A limestone
B ripple marks

C magma

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5 Scientists classify rocks by ....

B color and size
C mass

A composition and texture

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6 Which of the following rocks is not normally used as a construction material?

B marble
C limestone

A halite

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7 The process in which water, wind, ice, and heat break down rock is called?

A uplift
B instrusion

C weathering

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6.2 Igneous Rock

I. Formation of Magma
- A. Magma cools and hardens to form igneous rock
  - 1. Most igneous rock can be identified as crystalline (made of crystals)
    - a. Chemical composition of minerals + texture of rock determine identify of the igneous rock
- B. Magma forms when rock melts
  - 1. Three factors affect if rocks melts: temp, pressure, and pressure of fluids in rock
- C. Partial melting— process by which different minerals in rock melt at different temps
  - → Figure 1 p. 129
- D. Functional crystallization- crystalization and removal of different minerals from the cooling magma

II Textures of Igneous Rocks
- A. Magma that cools deep inside the crust forms intrusive igneous rocks
- B. Lava that cools at Earth's surface = extrusive igneous rock
- C. Coarse-grained igneous rock - forms from slow cooling of rocks; has large crystals

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D. Fine-grained igneous rock - forms from rapid cooling; has small crystals

E. Other Igneous Rock textures
1. Mixture of large + small crystals = porphyrite texture
2. Glassy texture - small % of dissolved gases
3. Rapid cooling produces rock w/ porous texture = vesicular

III Composition of Igneous - (determined by chemical composition)
A. Three families of igneous: felsic, mafic, intermediate
1. Felsic - high in silica, has light coloring
2. Mafic - low in silica, have a darker color
3. Intermediate - silica = < felsic, > mafic

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IV Intrusive Igneous Rock Structures (form underground)
A. Batholith + Stocks
1. Batholiths - intrusive formations that spread over 100 km^2 when exposed on Earth's surface
2. Stocks - similar to batholiths but cover less than 100 km^2

B. Laccoliths - base of intrusion is parallel to rock layer beneath it
1. Means "lake of rock"

C. Sills and dikes
1. Sills - when magma flows between layers of rock + hardens
2. Dike - when magma causes a vertical fracture in rock layers + solidifies
a. common in volcanic areas

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I Extrusive Igneous Rock structures

A. Igneous masses that form on Earth's surface = extrusive

1. Volcano - vent through which magma, gases, ashes are expelled
   a. Solidified central neck = volcanic neck
2. Many extrusions are flat masses of solidified magma = lava flow
3. Series of lava flows that cover a vast area of thick rock = lava plateau
4. Volcanic ash deposits = tuffs

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6.2 Review

Grade: 9th

Subject: Earth Science

Date: 12/6

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1 Which of the following are ways magma is formed?

A by compaction and cementation

C by changes in composition
D by weathering and erosion

B by melting and cooling

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2 What kind of texture does igneous rock have when magma cools slowly?

B large-grained
C fine-grained
D medium-grained

A coarse-grained

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3 What kind of texture does igneous rock have when magma cools rapidly?

A coarse-grained
B medium-grained
C large-grained

D fine-grained

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4 What kind of rock is formed when magma intrudes into other rock?

A extrusive igneous rock
B sedimentary rock

D organic sedimentary rock

C intrusive igneous rock

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5 What kind of rock is formed from lava that cools on the Earth's surface?

A organic sedimentary rock
B sedimentary rock
C instrusive igneous rock

D extrusive igneous rock

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6.3 Sedimentary Rock

→ Loose fragments of rock, minerals, and organic material from natural processes are called sediment

I. Formation of Sedimentary Rock
A. Sediments are generally transported by wind, water, or ice
1. As sediments move, their physical + chemical characteristics change
B. Two main processes convert loose sediment to sedimentary rock
1. Compaction- sediment grains are compressed
2. Cementation- sediment grains are glued together by minerals

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II Chemical Sedimentary Rock
A. Forms due to mineral precipitation or settling from a suspension
1. Minerals deposits due to evaporation = evaporites

III Organic Sedimentary Rock
A. Forms from remains of living things
1. ex: coal, some limestones (chalk limestone)

IV Clastic Sedimentary Rock
A. Made of rock fragments that are carried away from their source by water, wind, or ice and left as deposits
1. then become compacted or cemented to form rock
B. Classified by the size of the sediments in the rock
→ See Figure 3, p. 137 to see differences between Conglomerate, Breccia, Sandstone, Shale

V. Characteristics of Clastic Sediments
A. Sorting
1. Very well → very poorly: see Figure 4 p. 138
B. Angularity - sediments can be angular/uneven → smooth/round
1. More smooth/rounded, the further sediment is from source

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VI Sedimentary Rock Features
A. Stratification - occurs when conditions of sediment deposition change
B. Cross-beds and graded bedding
1. Cross-beds - slanted layers that form within beds (river beds)
2. Graded bedding - occurs when different sizes + shapes of sediments settle to different levels
a. largest grains on bottom, smallest on top
3. Reverse grading - smallest grains on bottom, large on top
C. Sedimentary rock may show ripple marks or mud cracks
D. Fossils - remains/traces of ancient plants/animals

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6.3 Review

Grade: 9th

Subject: Earth Science

Date: 12/11

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1 Which process forms sediment?

B cementation
C compaction
D deposition

A weathering

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2 What are strata?

A mineral fragments
B minerals crystallized out of solution

D fossils in sedimentary rock

C layers in sedimentary rock

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3 What kind of sedimentary rock is made of fragments of rocks cemented together by a mineral?

A organic
B stratified
C chemical

D clastic

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4 What kind of sedimentary rock is made of fossils?

B chemical
C stratified
D clastic

A organic

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5 What kind of sedimentary rock is made from solutions of dissolved minerals and water?

A organic

C stratified
D clastic

B chemical

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6 What is the process called in which sedimentary rocks are arranged in layers?

A erosion
B extrusion
C weathering

D stratification

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6.4 Metamorphic Rock

I. Formation of Metamorphic Rock
- A. Forms from changing of rock type due to heat, pressure, or chemical processes
  - 1. Generally forms deep in Earth's crust
    - a. All metamorphic forms from existing igneous, sedimentary, or metamorphic rock
- B. Two types of metamorphism in Earth's crust
  - 1. One type occurs when small volumes of rock contacts magma
  - 2. 2nd type occurs when large areas of Earth's crust are affected by heat and pressure caused by movement in tectonic plates

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C. Contact Metamorphism
1. Rock comes into contact w/ magma
   a. only a small area of rock that surrounds hot magma is changed by the magma's heat

D. Regional Metamorphism
1. Metamorphism that occurs over a large area
   a. due to changes in temperature and pressure
2. generally a result of tectonic forces

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II Classification of Metamorphic Rocks
A. Metamorphic rocks are classified by chemical composition, however they are first classified by texture

B. Foliated Rocks
1. texture in which minerals are arranged in planes or bands
2. Forms by two ways:
   a. extreme pressure causes mineral crystals to realign to form parallel bands
   b. Minerals that have different compositions seperate to produce a series of alternating dark & light bands
   c. Gneiss- metamorphosed rock w/ light & dark minerals

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C. Nonfoliated Rocks - no bands or aligned minerals

1. 2 main characteristics

a. original rock metamorphosed and may contain one mineral or very small amounts of other minerals

b. original rock may contain grains that are round or uneven

c. Quartzite + Marble are common nonfoliated rocks

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6.4 Review

Grade: 9th

Subject: Earth Science

Date: 12/13

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1 Process other than heat that causes metamorphism

A cementation
B lava flows

C pressure

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2 Process in which crystals in minerals change in size or composition

A foliated
B nonfoliated
C regional metamorphism

D recrystallization

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3 Metamorphic rock in which mineral grains are NOT arranged in planes or bands

nonfoliated

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4 A change in shape of rock caused by force is...

A foliated
B nonfoliated
C recrystallization

D deformation

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5 What is one example of a foliated metamorphic rock?

Gneiss

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6 Result of large pieces of rock deep within the Earth's crust colliding is...

A contact metamorphism
B recrystallization

D extrusive formations

C regional metamorphism

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